DOCUMENT RESUME

ED 148 106 FL 008 943

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TITLE	The Effect of Bilingualism in Children from Spanish-English Low Economic Neighborhoods on Cognitive Development and Cognitive Strategy. Working Papers on Bilingualism, No. 14.
INSTITUTION	Ontario Inst. for Studies in Education, Toronto. Bilingual Education Project.
SPONS AGENCY	National Inst. of Child Health and Human Development (NIH), Bethesda, Md.
PUB DATE	Oct 77
GRANT	HD-08393
NOTE	45p.; For related documents, see FL 008 939-942
AVAILABLE FROM	Bilingual Education Project, The Ontario Institute for Studies in Education, 252 Bloor St. West, Toronto, Ontario, Canada M5S 1V6 (as long as supply lasts)
EDRS PRICE	MF-$0.83 HC-$2.06 Plus Postage.
DESCRIPTORS	Association (Psychological); *Bilingualism; *Bilingual Students; Child Language; *Cognitive Development; Cognitive Processes; Disadvantaged Youth; Egocentrism; Language Development; Language Tests; Minority Groups; *Perceptual Development; *Psycholinguistics; Semantics; *Socioeconomic Influences; Spanish Speaking; Syntax; Verbal Development; Verbal Learning
IDENTIFIERS	Language Processing

ABSTRACT

A previous study found that middle-class Hebrew-English bilingual children were characterized by distinctive perceptual strategies and more advanced processing in certain verbal tasks, as compared to similar monolinguals. The present study tested whether similar strategies and response patterns will appear when the children involved are from different language groups and from relatively disadvantaged inner-city neighborhoods. The results showed that Spanish-English bilingual children manifest similar strategies to those found in the previous study, although with some attenuation. The strategies apply to nonverbal as well as verbal material. These results appeared in spite of deficiencies in vocabulary and syntax usage for the Spanish-English bilinguals relative to their control group of similar ethnic and social background. (Author/CPM)

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Abstract

A previous study found that middle-class Hebrew-English bilingual children were characterized by distinctive perceptual strategies and more advanced processing in certain verbal tasks, as compared to similar monolinguals. The present study tests whether similar strategies and response patterns will appear when the children involved are from different language groups and from relatively disadvantaged inner-city neighborhoods. The results show that Spanish-English bilingual children manifest similar strategies to those found in the previous study, although with some attenuation. The strategies are attention to structure and readiness for reorganization. The inclusion of additional tests show that these strategies apply to nonverbal as well as verbal material. These results appeared in spite of deficiencies in vocabulary and syntax usage for the Spanish-English bilinguals relative to their control group of similar ethnic and social background.

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THE EFFECT OF BILINGUALISM IN CHILDREN FROM SPANISH-ENGLISH LOW ECONOMIC NEIGHBORHOODS ON COGNITIVE DEVELOPMENT AND COGNITIVE STRATEGY[1]

Sandra Ben-Zeev

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Previous work (Ben-Zeev, 1972, 1977) investigated the influence of bilingualism on syntactic and semantic processing and on nonverbal tasks. It was found that two cognitive strategies characterized the behavior of the bilinguals through various of these tasks, namely, readiness to impute structure and readiness to reorganize.

The subjects of the earlier study were Hebrew-English bilingual children from highly educated families. In the environment of those children both languages were highly valued and bilingualism itself was usually a conscious value. The present study tests whether similar results will be found for children who are bilingual in a different combination of languages-- Spanish and English-- and who are from families of a much lower educational and economic level. In the latter environment the native Spanish language tends to be somewhat lower in status, according to the children's preference statements, and in spontaneous discussion the children tend not to talk about bilingualism as a positive value.

In both cases the main hypothesis was that repeated interlingual interference causes the child to develop a language strategy which helps resolve such interference. Specifically, on the syntactic level it was predicted that as a result of having had to cope with many mistakes in language interpretation, bilinguals would be more ready than other children to reorganize their perceptions of meaningless speech stimuli, as if actively searching for a rule-based framework for interpretation. It was also predicted that bilinguals would show greater ability to recognize that syntactic system rules are arbitrary and that they would show greater willingness to change the rules of the system when this is required. Both of these predictions were supported by the results from the earlier study.

On the semantic level it was predicted that bilinguals would give associations based on concept-relations more than associations based on sequences within the sentence. The theory was that the early tendency to attach a word to a sentence context in which it is often heard has met interference from the contrasting sentence structure of the other language in the case of the bilinguals, which would lead the latter to earlier recognition of those aspects of words which are more intrinsic and less variable by language, namely, their conceptual meanings. There was some minor supporting evidence for this in the results of the earlier study, but it was not conclusive. The failure to find stronger effects may have been due to the fact that the vocabulary of the bilinguals was deficient, since vocabulary level was significantly related to the occurrence of conceptual associations. Conceptual associations are more demanding upon vocabulary, which may have caused inhibition of conceptual associations in the case of the bilinguals.

Concerning the possibility of generalization of bilingual strategies to nonverbal tasks, the earlier study found that the bilinguals were not better on matrix transposition tasks as a whole, as compared to monolinguals, but they were superior in ability to isolate the basic dimensions underlying the matrix and in scanning the field of possible responses.

The present study employs five tests which significantly differentiated in some respect between linguality groups in the previous bilingual study, along with several new tests. As before, the tests concern syntactic processing, semantic processing, and other kinds of analytic processing.

METHOD

SUBJECTS

There were 98 bilingual Spanish-English speakers and a comparison group of 90 children of Latino heritage who speak only English. Most of the bilinguals' parents were foreign and most of the monolinguals' parents were United-States mainland born. Ultimate country of origin of both groups was Mexico (78% of total sample), Puerto Rico (14%) or various other Caribbean islands.

The age range was 5;4 to 9;8, with mean age 7;4. There were no significant differences by Age, $t = .69$, N. S., or by Sex, $\chi^2 = 2.13$, N. S.

Teachers in 8 Chicago Public Schools submitted names of potential bilinguals and potential monolinguals, excluding children with hearing or learning defects. Children from both lists were given individually a 12-sentence translation test in which each sentence spoken to the child had to be translated by him orally to the other language. The items alternated between English to Spanish and Spanish to English. Vocabulary of the items was very simple but all translations required considerable structural change. Children unable to translate more than one or two sentences were eliminated from the bilingual group and from the experiment. Supposed "monolinguals" who knew more than a few common Spanish words were also eliminated.

Children selected for the bilingual group were assigned to testers and to languages for testing according to a combination of their own statements concerning which language they knew best and of observation of their translation performance. When the two languages seemed equally strong the

tests were administered in English, since that was the language of the school and the test language was formal, like the language used in school.

Translation test performance was later analyzed by a more formal coding system developed after examination of the full range of translation responses. From both the initial judgement and the later coding it appeared that about as many bilinguals favored one language as the other, with a few more protocols leaning towards Spanish.

About one-half of the monolinguals were found in the same schools as the bilinguals, in neighborhoods which were 70%-90% Latino. The other monolinguals were found in neighborhoods 30%-69% Latino. All of these neighborhoods were low economic areas, but the economic status of the less Latino neighborhoods was slightly higher, according to census figures concerning percentage of families on public assistance. Thus the monolinguals were slightly higher economically.

The following composite portrait of the typical bilingual child in the sample is derived from questionnaire responses gathered from all of the bilingual children and from 82% of their families. The child at first spoke only Spanish and began to become bilingual at around age four, when entering preschool or when contacts with neighborhood children expanded. The child occasionally translates for other people from language to language, but not frequently. He thinks he speaks Spanish better but he likes English better. He speaks only Spanish to both parents. The typical father speaks Spanish most of the time but occasionally English, though usually not in the home. Mothers follow this trend, but more of them never speak anything but Spanish.

PROCEDURE

Children were tested individually and orally, usually in two sessions of about fifty minutes each, with tests in a fixed order.

Tests for which there was a question of reliability were coded independently by two to four coders, after necessary orientation.

Intelligence was estimated by pro-rating the following four Wechsler Intelligence Scale for Children subtests: Similarities, Digit Span, Picture Completion, and Picture Arrangement. (For rationale, see Ben-Zeev, 1977).

Dependent Variable Tests

In the list below, a star indicates that this test had been used in the Hebrew-English (H-E) study also.

Tests of flexibility in syntactic rule usage:

Verbal Transformations*
Symbol Substitution*
Grammar Usage in Telling Stories

Semantic Tests:

Conceptual Associations*
Peabody Picture Vocabulary Test* (English only)

Analytic Tests:

Matrix Transposition*
Classification and Reclassification
Egocentrism in Telling Stories
Integration of Parts in Telling Stories
(WISC Intelligence Subtests)

Regarding the reasons for adding the various other tests: The grammar measures used in this study were more naturalistic than the grammar test in the other study, since they are based on a sample of the child's own speech in both languages. The other new measures are analytic tests. Among these, the need for a classification test was suggested by a secondary finding in the previous study that bilinguals were better at isolating dimensions of a stimulus pattern (in Matrix Transposition) and also readier to reorganize (Verbal Transformations, Symbol Substitution). Both of these characteristics seem to be involved in classification and reclassification.

The hypothesis that bilinguals might be better at overcoming egocentrism came both from the finding that they are readier to reorganize, which seems involved in taking the point of view of the other, and the fact that they have direct experience in viewing the world from two different language perspectives.

The idea that bilinguals might be better at integrating the parts of a situation or story into a whole came from the hypothesis that the bilingual must not only be prepared to change languages when necessary but also to resist interference from the other language by noting and relying upon the consistency within the language being used at the moment. If so, this characteristic might be expected to generalize to nonverbal cognitive areas as well.

Intelligence is listed in parentheses in the above outline because although it was controlled for in the main analysis of variance, in a separate analysis it was treated as a dependent variable, both as a whole and by subtests.

Data Analysis

Computer procedures were in accordance with Nie, Hull, Jenkins, Steinbrenner & Bent (1975). Independent variables for the main analysis of variance were: Linguality (bilingual vs. monolingual); Age (5;4 to 6;11 vs. 7;0 to 9;8 years); and Economic Level ("low" vs. "middle" vs. "high", all of these being variations within the overall low economic level). Cut-off points for economic level were determined by census rating for school neighborhoods. As stated above, for this analysis WISC intelligence was controlled for by being treated as a covariate. In this particular analysis cases with considerable missing data were eliminated, which reduced the sample to 154 subjects. Data were usually "missing" when the child answered in a form which could not be coded in the preset scoring categories, or else the parent questionnaire was missing. No systematic bias was involved in this elimination, as far as can be determined. The total sample for the other statistical procedures consisted of the larger sample of children.

RESULTS

1. Tests of Flexibility of Syntactic Rule Usage:

A. Verbal Transformations.

The test.

In this test a nonsense word is repeated continuously by means of a tape loop and the child must report what he hears. Warren & Warren (1966) found that when subjects listen to a clearly pronounced verbal stimulus presented at the rate of two per second they report frequent changes in what the voice appears to say. They found that at around age six children rather abruptly begin increasing the number of "transformations" they hear, indicating susceptibility to the illusion of change most characteristic of adults.

The stimulus words in both studies were flime and tress, pronounced with an American midwest accent. The phonemes and transitions in these words conform to the structure of both Spanish and English, although the allophones are, of course, English. Each stimulus was presented for two minutes. The child was instructed that he may or may not hear changes, and that if he did hear any change it was to be reported immediately, as it occurred. Responses were noted by hand and the time noted by stopwatch. If the child was silent for over

half a minute during the test period he was asked, "What do you hear?", and the response was recorded.

Results

The flime stimulus was first on the tape, and during the intensive usage in this experiment the first half-minute or more of this stimulus began to become indistinct through wear. For this stimulus the differences between groups were not significant. For the tress stimulus the results were quite similar to those in the earlier experiment. The bilinguals heard a significantly higher number of stimulus changes, F (1,151) = 10.74, $p < .01$, bil. mean = 14, mono. mean = 10. The changes reported by the bilinguals were significantly more varied, F (1,151) = 6.83, $p < .01$, bil. mean = 7, mono. mean = 6. The bilinguals heard more changes in the first 30 seconds, F (1,151) = 7.86, $p < .01$, bil. mean = 4, mono. mean = 3. The first change occurred earlier for the bilinguals, F (1,151) = 5.35, $p < .05$, bil. mean = 12 seconds, mono. mean = 19 seconds.

There was no significant difference between groups in the number of real English words reported. Not many Spanish words were reported, but these tended to come from the younger bilinguals, Linguality x Age interaction, F (1,151) = 3.75, $p = .052$. The bilinguals had significantly fewer pure rhythm responses (responding to the 2 items per second rhythm alone, e.g., "wha, wha,wha"), F (1,151) = 3.99, $p < .05$, bil. mean = .01, mono. = .17. The latter indicates that the bilinguals seem to be attending to the content of the verbal stimulus more closely than were the monolinguals.

B. Symbol Substitution.

The test.

All items in the test require substitution of one meaningful word for another within a given sentence frame. At the lowest level this task requires ability to understand that a word is only arbitrarily related to its referent and therefore can be substituted by another word. At the highest level it requires deliberate violation of the usual semantic selectional restrictions within the sentence. (Example: "In this game instead of saying 'I' we say "spaghetti". How do we say: 'I am cold'?" Correct answer: Spaghetti am cold.) To answer correctly the child must resist the influence of the sentence frame on the form of the item, as well as the influence of the substituted item on the sentence which surrounds it. (In the above example the child is likely to say either "Spaghetti is cold", or "I am spaghetti". Either of these fits the selectional restrictions of English better but would be incorrect.

In addition to total score, seven types of errors were analyzed, as follows:

Failure to offer any substitution, "Don't know" response.
Inclusion of both substitution word and word which should be replaced, with both words adjacent.
Placement of the substitution word before or after the original sentence, leaving the latter intact.
Global response--the child utters the substitution word in place of the entire sentence.
Use of the substitution word in place of the initial word of the sentence.
Success in the substitution task but at the expense of omitting two or more of the words of the original sentence. This type of response was common for the longer stimulus sentences, and the omitted words were usually the less important function words.

Results.

For total score on the Symbol Substitution Test there were no significant differences between linguality groups.

Scores were dependent upon Digit Span, F (1,153) = 9.76, $p<.01$, indicating that memory for the sentences was a limiting factor. The general level of performance was low, and even the earlier, easier items on the test were found to be difficult.

There were some significant differences in types of error. The bilinguals made significantly fewer global-type errors, F (1,153) = 5.54, $p<.05$, bil. mean = .39, mono. mean = .72. This is a low-level error indicating difficulty in even attempting to analyze the sentence into parts. The younger bilinguals, especially, made fewer errors of this type, Linguality x Age interaction, F (1,151) = 6.14, $p<.05$, bil. young mean = .26, mono. young mean = 1.18, bil. old mean = .43, mono. old mean = .43.

The same tendency for bilingual advantage among the younger children was seen also in non-significant interaction effects for two other error measures. The "missing words" error is a relatively high type of error because the child does actually succeed in making the required substitution. The Linguality x Age interaction for this mistake, F (1,153) = 3.30, p = .068, indicates that among the younger children the bilinguals tend to have more of this type of response.

The other error whose interaction effect was about the same, F (1,154) = 3.35, p = .066, and whose means went in the same direction as the "missing words" error was "initial word substitution". This error is not as high-level as the "missing word" error, but at least the child is conforming to the task requirement sufficiently so that one word is substituted for another.

C. Grammar Usage in Telling Stories.

The test.

These measures were derived from the speech of the child as he described a series of cartoon pictures which told a story and then answered questions about the story.

The child's speech was recorded by hand as well as on tape and later transcribed. Sentences were the units of analysis. A segment was considered a sentence when there was a main verb and at least one other principal constituent--subject, direct or indirect object, or prepositional phrase. Even statements lacking verbs were considered sentences when the subject and sufficient other constituents were present to make the nature of the missing verb evident. Exact repetitions were not counted. When the child replied to questions from the experimenter with incomplete sentences, beginning conjunctions were eliminated and the remainder of the segment was counted as a sentence. Separation between sentence units was determined mainly by content, i.e., whether the unit expressed an independent thought. Pauses were considered validating but not criterial. The phrase "and then" was used as a cue to indicate a new thought.

For the bilingual subjects the first two stories were given in their best language and the third story in their other language. A bilingual psycholinguist coded all of the Spanish protocols and some of the English. Another coder with knowledge of Spanish coded English protocols and some of the Spanish to establish reliability. A third coder did only English protocols. Considerable time was spent establishing common definition of coding categories.

There were three types of measures: (a) measures of adherence to various phrase structure rules, (b) a measure of syntactic complexity, and (c) a measure of correct logical usage.

Measures of adherence to phrase structure rules--

Overall grammaticality-- This is the ratio of sentences which were grammatically correct to the total number of sentences. A sentence was counted as incorrect only once, regardless of the number of individual errors it contained. Thus, for example, the error could be in a particular verb, in several parts of the sentence, or it could represent a totally confused sentence. This measure includes all sentence errors in all three stories, irrespective of the language of the story.

Percentage of main verb errors in best language-- Main verbs were defined to include the first verbs in a verbal construction. Auxiliary verbs were counted as part of the main verb. Redundant use of tense (e.g., "smelleded") was not considered an error, since it indicates knowledge of the tense rule. Use of "don't" with third person singular subject (e.g., "he don't go") was not counted as an error because it may represent standard local dialect.

For the bilinguals only the verb errors in the first two stories were counted because these were in the child's best language. Possible bias effect of this is discussed below.

Number of modals in best language-- Modals were counted whether in positive form ("can","would", etc.) or negative form, whether full or contracted ("can not", "can't"). The "do" auxiliary was not considered a modal in any form. Only responses to the first two stories were coded for all subjects. This was because the measure here concerns absolute number rather than percentage, so number of stories must be the same for both subject groups.

Percentage of preposition errors in best language-- For the bilinguals only the errors in the first two stories were counted because these were in the child's best language.

Measure of syntactic complexity--

Percentage of clausal sentences, both languages-- A sentence is counted as clausal if it contains a main clause and a subordinate clause. Another measure which was taken here were Percentage of clausal sentences which contain errors. The error could occur either in the main clause or in the subordinate clause.

Measure of correct logical usage--

Illogical use of conjunctions in clauses-- An example is the use of "because" in the following sentence: "He went to his room 'cause he didn't have to talk to his father". It appears from the context that "because" in this case means in order that, rather than as a result of.

In checking reliability, concentration was on ratings for number of sentences and for preposition errors, since the other measures were more clearly definable and agreement was nearly perfect. Initially the main rater for the Spanish protocols assigned a greater number of sentences, but this was resolved after discussion, after which about 80% of the sentence number ratings agreed, and disagreement was rarely more than a difference of one or two sentences.

The difficulty with preposition errors was that to some raters sentences such as "He got up in a apple tree" and "He broke the window from (i.e., 'of') a car" sounded erroneous while to others they sounded more like particularized usages instead of errors. In any case, very few of the preposition errors were the errors of logical usage which had been anticipated.

Results.

The bilinguals were significantly worse on the measure of Overall grammaticality, F (1,151) = 11.09, $p<.01$, bil. = 19% erroneous sentences, mono. = 14% erroneous sentences.

On Percentage of main verb errors in best language the bilinguals were significantly worse, F (1,151) = 23.06, $p<.001$, bil. mean = 10% errors, mono. = 4% errors. If there was any bias resulting from the fact that the mean for the monolinguals included the third story the bias would have been in the other direction, since the content of that story is possibly slightly more complex and therefore possibly more difficult to express.

On Number of modals in best language the difference was not significant. There was a trend for the bilinguals to have fewer modals, F (1,151) = 3.51, $p<.060$, bil. mean = .82, mono. mean = 1.32.

On Percentage of preposition errors in best language the bilinguals made significantly more errors, F (1,151) = 7.87, $p<.01$, bil. mean = 13%, mono. mean = 7%. The errors were very rarely in logical use of prepositions, e.g., a child would not substitute "in" for "on", or substitute one logical preposition meaning for another, generally. Instead, "errors" were more a matter of multiple usage, unconventional usage (e.g., "He broke a window from [of] a car"), or omissions (e.g., "they knocked [on] the door".

Percentage of clausal sentences gave no significant difference between linguality groups. Thus no difference in level of sentence complexity between bilinguals and monolinguals was found. However, the bilinguals had a significantly higher percentage of Clausal sentences with errors, F (1,151) = 10.18, $p<.01$, bil. mean = 21%, mono. mean = 10%.

The Percentage of clauses which use conjunctions illogically did not differ significantly between groups.

Discussion of results of the syntactic tests.

The results of the Verbal Transformations Test are very similar in both direction and strength between this study and the previous H-E bilingual study. In these studies the repetitious stimulus feedback can be interpreted by the hearer as a cue that an acceptable closure has not been achieved. In both studies the bilinguals seem to have been spurred by this to engage in especially strong processing effort, in the form of continuing auditory reorganization of the stimulus, in order to discover some framework for interpretation so that the stimulus will make sense. This result is in accord with the original hypothesis that bilinguals are prepared to exert greater processing effort in the sense of readiness to reorganize incoming speech perception, as a result of their frequent experience of interpretation errors.

There are some problems of data interpretation. In the present study the tester's question concerning whether there had "really" been changes often resulted in denials by the bilinguals who had reported changes. Although the bilinguals did tend to say that the changes were "real" more than did the comparison group, the differences between groups was not significant, in spite of the increased number of the changes which the bilinguals had reported.

Should we conclude that the bilinguals' changes were false, merely offered to somehow please the tester? This seems unlikely, since the changes they reported did correspond to the conditions of the task. They reported fewer changes in the flime stimulus, which was actually less distinct, than on the clear tress stimulus, and they began hearing the changes on the unclear stimulus later, just as did the monolinguals. Also, although a few children reported changes deviating widely from the stimulus itself phonemically, which leads to the suspicion of possible "intentional" changes, the bilinguals did not do this more than others.

An alternative possibility is that the bilinguals' response to the question concerning "real-ness" of the changes indicates willingness to attend to the implicit suggestion that their perception may have been mistaken. It is uncertain whether this should be interpreted as another instance of cognitive flexibility or as a sign that these bilinguals were unusually anxious to please and especially sensitive to social signs that they may have erred.

Concerning tests for knowledge of grammatical rules, it is difficult to compare the results of this study with those of the H-E study, because the latter used a Berko-type test of ability to generalize grammatical rules whereas the present study looked at actual sentences produced by the child. In the H-E study it was found that the bilinguals could generalize the rules as well as their comparison group. In the present study it was found that the mastery of some basic rules such as for verb tense and person and for preposition choice was inferior for the bilinguals.

It is interesting to note that in spite of the inferiority of the Spanish-English bilinguals in mastery of grammatical rule usage, their sentence construction was not found to be inferior in complexity (as measured by percentage of clausal constructions) or in logic. One of the stories in particular involved rather complex relationships which were almost impossible to convey without complex sentences. The bilinguals were able to do this, even though at the cost of a very high number of errors as compared to the monolinguals. It has been suggested that there are trade-offs among the syntactic, semantic, and pragmatic intentions of the speaker (Bloom, 1976). It is worth investigating whether some types of bilinguals find it useful to adopt a strategy of concentrating on the pragmatic. That is, do they concentrate on conveying an idea at its appropriate level of complexity, even if to do this sometimes requires a deficit in syntactic performance even more exacerbated than the deficit normally manifested?

Unlike the bilinguals in the H-E study, these bilinguals were not superior on Symbol Substitution, a test which requires a more analytic, metalinguistic approach to grammar. Yet secondary measures on the latter test show that at the simplest levels of analytic response to grammar the grasp of these bilinguals is surer, and that this difference is strongest at the younger age level. The result is in the same direction as

in the previous study, but weaker.

In future research with the Symbol Substitution Test with bilinguals such as those of this study, who have trouble with obligatory agreement rules, sentences should be kept short and as near to telegraphic as possible without violating the grammar. Some of the sentences which were used in this study were as long as seven words, and the bilinguals may have been distracted from the substitution task by the need to attend to all the words and to the agreement rules. The tendency of the bilinguals to leave out particles and other minor words of the sentence indicated that the length of the sentences were indeed especially taxing of memory for them, thus leaving less processing time available for substitution. Thus difficulty with the kind of rules which are usually automatic by the age of these children may have masked special skill the bilinguals may have on a more sophisticated level of grammatical rules.

2. Semantic Tests:

A. Conceptual Associations.

The test.

In the previous study this test was called "Paradigmatic Associations", and responses were classified according to whether they were of the same part of speech as the stimulus word (paradigmatic response) or of a part of speech which could be contiguous with it in a sentence (syntagmatic response). These terms may be somewhat misleading. Both types of responses are essentially semantic but the responses called "paradigmatic" are more conceptual in that they usually establish the stimulus word in a semantic hierarchical organization (McNeill, 1971). This type of response will be called here "conceptual". The term "syntagmatic" response will be retained, for lack of a better term, but this type of response may indicate not a concern with syntax but either an attempt to root the stimulus word in a concrete situation, or else the automatic running off of frequently experienced sequences (e.g., GO: home).

Concerning bilinguals, the hypothesis is that the contrast in rule structure between the two languages predisposes the bilinguals to begin organizing their words earlier in memory storage in terms of semantic feature systems. Thus they should have more associations of a conceptual type. In order for this effect to manifest itself it would have to overcome the low vocabulary of the bilinguals, which places limits on performance when it comes to conceptual associations, if not on the very competence to form such associations.

In the present study, responses classified as "conceptual" had not only to be of the same part of speech as the stimulus word but had also to share enough selectional restrictions that the words could meaningfully substitute for each other in a sentence. The coder's decision was made somewhat easier because none of the stimulus words were nouns, which often have broader meaning ranges (because of polysemy, homonomy) than other parts of speech.

"Syntagmatic" responses must be likely to follow or precede the particular stimulus word, not just the general part of speech to which the stimulus belongs. One missing intervening article or preposition was permitted.

A special category of "syntagmatic" response was called "Global Syntagmatic Response". Here the child is unable to follow the instruction to give a one-word response, and in spite of correction insists upon giving phrases or whole sentences as responses, often including the stimulus word.

Responses which did not fit the above categories were coded as follows: Associative responses--These are connotatively related to the stimulus word, but in a way which is neither Conceptual nor Syntagmatic by the present criterion; Grammatical Variant--These are a variant of the stimulus word but differently inflected (e.g., GO:went). Defective--Responses which are unrelated, rhyme responses, refusals; Negations--(GO: don't go; FULl: not full).

The ten stimulus items consisted of four verbs, two adjectives, two prepositions, and two adverbs. The two forms were translations of each other. As before, the test was given in the child's best language. Children were not permitted to switch to the other language in responding.

Results.

There were no significant differences between linguality groups for number of Conceptual responses or for number of "Syntagmatic" responses. The other response categories also showed no significant differences. The language in which testing was done appeared to have no influence on the results (for Global Syntagmatic responses, t (94) = .002, N. S.; for Conceptual responses, t (97) = .250, N. S.).

Two different types of secondary analyses were done to try to compensate for the possibility that poor vocabulary of the bilinguals was masking differences in conceptual organization on this task. The Associative responses (11% of the total responses) were analyzed further, and the

patterning of Negation responses (1.8% of the total) was also analyzed.

Initially a "Conceptual" response was defined as a type of Paradigmatic response, since it had to be of the same part of speech as the stimulus word, as well as conceptually related. In contrast, some types of "Associative" responses are conceptually related to the stimulus word, e.g., they are synonymic or antonymic in some sense, although they are not of the same part of speech. (Examples: FULL: lot; whole; stuffy; LLENO: subidos; nada).

This type of Associative response is as indicative of concern with semantic structure as is a Conceptual response, but the Associative response is probably less demanding on vocabulary because the conceptually related response is not limited to the same part of speech as the stimulus word, and thus more lexical items are eligible.

Associative responses were broken down into Conceptual-Associative responses and Syntagmatic-Like responses. Conceptual-Associative responses are defined as above, i.e., not of the same part of speech as the stimulus word, or substitutable for it only in limited contexts, but still conceptually related. Syntagmatic-Like responses are like Syntagmatic responses but fail the initial criterion for these because the response is too distant from the stimulus word in a possible sentence (e.g., WALK: store; ground).

After determination that the Spanish vs. the English protocols of the bilinguals did not differ in number of Associative responses, $\chi^2(2) = 3.16$, N. S., all bilingual protocols were combined and contrasted with the monolingual protocols. Here a significant difference appeared in that the bilinguals had more Conceptual-Associative responses, $\chi^2(2) = 6.10$, $p<.05$.

The reanalysis of patterns with Negatives was based on the idea that Negatives are antonymic and in this sense are an easy type of conceptual response. They had not been included in the Conceptual category because of their facile quality, and in fact in the earlier bilingual study they had not been permitted as a type of response. The reanalysis found that although bilinguals do not give more negative responses in general, what negative responses they do give tend to be concentrated in the following kind of pattern: genuine Conceptual responses are given to the first two

stimulus words, which happen to be very simple and frequent words (GO; NEW). To the next six stimulus words in the list, which are more demanding (AGAINST; CUT; NEVER; THROW; WALK; and FULL), the child gives one or more Negative responses. This pattern of negative usage appeared in 20% of the bilingual protocols, and the difference from the monolinguals was significant, χ^2 (1) = 6.79, $p<.01$. This indicates that there is a tendency for the bilinguals to give more conceptual responses but that this tendency is hindered by vocabulary deficit. The deficit appears on the relatively less frequent stimulus words, for which the bilingual has less experience.

B. Peabody Picture Vocabulary "IQ".

The test.

As in the previous study, the test was administered only in English, because it has not been normalized in the other languages.

Results.

The Spanish-English bilinguals were significantly lower in Peabody Vocabulary "IQ" scores than the monolinguals, F (1,154) = 7.99, p = .001, bil. mean = 89.81, mono. mean = 101.35.

The mean score for those bilinguals who leaned towards English, as judged by the translation test directionality score, was 89.49, which is very close to the score for the whole bilingual sample.

Discussion of Results of Semantic Tests.

In the secondary analyses of the association test responses the bilinguals showed increased semantic classification or organization. The stimuli for the association test were originally selected to create syntactic distinctions, not semantic. It would be useful to do an association study in which the stimuli are all concrete nouns of a type easy to place in a classification hierarchy (e.g., "bird") and to see if the effect found here is maintained or strengthened.

3. Analytic Tests.

A. Matrix Transposition.

The test.

In the original Bruner & Kenney (1966) test the child is presented with 9 cylinders which vary by 3 degrees of height and width so that they form a 3x3 matrix. The child is asked to describe the matrix and to transpose it. The adaptation of this test used in the present study is described in Ben-Zeev (1977).

Results.

There was no trend in performance on the actual transposition of the matrix. Among the measures concerning ability to perceive and describe the dimensions there was a trend for the younger bilinguals on the question concerning how two cylinders are "the same". This question was more difficult to answer than the question of how two cylinders were "different". Children would tend to describe a difference when asked for a similarity; or they would describe a similarity which is irrelevant to the structure of the matrix (e.g., "they are both made of wood"); or they would claim that the two cylinders cannot be "the same" because they are not identical. The younger bilinguals tended to answer this question more correctly in terms of the matrix, Linguality x Age interaction, F (1,153) = 3.30, p = .068.

It was also within the younger age group that the bilingual children more often indicated their explanations by gesture instead of words (Linguality x Age interaction, F (1,153) = 5.13, p = .024. On the question concerning similarity, for example, the younger bilinguals tended to indicate width or height similarity between the two cylinders by touching rather than by words.

There were no differences in the tendency to use relational terms (e.g., "smaller", "bigger").

B. Classification and Reclassification, Part 1.

The test.

According to a procedure suggested by Inhelder & Piaget (1964), the child was asked to classify a set of 8 stimuli into two groups, with the instruction that each group must be "all the same" in some way. The child was asked to do this 3 times, using a new basis for clasification each time. Possible classification dimensions were shape, color, and size. Following each of his classifications the child was asked to describe how the objects within each pile

are the same and are different from the objects in the other pile.

In the version developed here, whenever the child perseverated on the same dimension the following trial provided him with a "hint" designed to remove the perseveration. Thus, if the child classified by shape in both trials 1 and 2, the stimulus presented in trial 3 would include an additional shape so that it was no longer possible to classify into two groups simply by shape. If the child was then able to switch to a different dimension, he was allowed to proceed to a 4th trial. If he perseverated on this trial, a final 5th trial was presented which consisted of a new "hint" set in which both of the dimensions on which the child has perseverated are multipled. E.g., if perseveration was on shape and color, the child was provided with a set which included 3 shapes and 3 colors, though still only 2 sizes. Thus a child could receive from 3 to 5 trials, depending on the extent of perseveration and ability to overcome it.

Number of different correct classifications was one of the measures. To account for the differing number of trials, another measure of success was Percentage of total trials which were correct new classifications. One could get a high score on this measure either by classifying well without perseveration or else by having perseverations but being able to overcome them. Percentage of perseverative responses was a more direct measure of perseveration.

Another measure was Percentage of design responses. Design responses occur when the child not only divides the objects between two piles but goes on to organize within each pile according to one or more of the remaining dimensions. This kind of response is still correct, but it contains a greater amount of organization than is necessary to satisfy the task.

Percentage of explanations citing the wrong dimension: This occurs when the child classifies by one dimension but cites a different dimension in his explanation.

Results.

Number of correct classifications was not significant. Neither was Percentage of correct classifications. The latter did show a trend in favor of the bilinguals, F (1,151) = 2.88, p = .088, bil. mean = 60%, mono. mean = 52%. There was a similar trend in favor of the younger bilinguals, Lin-

guality x Age interaction, F (1,151) = 3.05, p = .079.

The main effect for Percentage of Perseverative Responses was not significant, although it was in the predicted direction, F (1,151) = 3.42, p = .063, bil. mean = 16%, mono. mean = 22%. Linguality x Age interaction was significant, F (1,151) = 6.00, p = .015. Younger bilinguals were more perseverative than the younger monolinguals, especially.

Percentage of design responses was higher for the bilinguals, F (1,151) = 5.71, p = .017, bil. mean = 27%, mono. mean = 14%. In this case the older bilinguals tended to be highest, Linguality x Age interaction, F (1,151) = 3.41, p = .064.

The main effect for Percentage of explanations citing the wrong dimension was not significant. The Linguality x Age interaction was, F (1,151) = 5.42, p = .020. Again, it was the older bilinguals who tended to do this most.

C. Classification and Reclassification, Part 2.

The test.

Six red objects differing in size and shape as in Figure 1 were presented in random array.

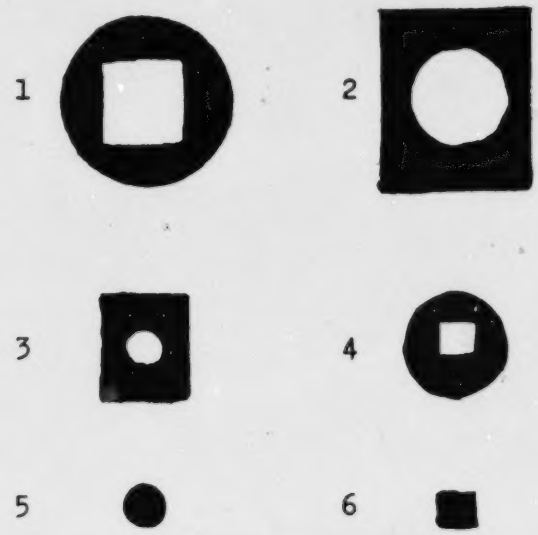

Figure 1. Stimuli for Part 2 of the Classification Test.

The Subject was told: "Here is a new set of things. Can you also put these new things into two piles, all the same in one pile and all the same in the other? Please use all of them."

Following the child's classification, the objects were mixed again and the child asked to classify them again into two piles, all the same in each pile, but in a different way. If correct, the child is asked to classify in still a third way.

There were no "hints" on this task. Perseveration was counted as a wrong response but the child was informed of his error and given another chance. There was a maximum of four trials. The children were asked to explain each time how all the objects in each of the two piles were the same.

The following classifications were considered correct:
Outside circles vs. outside squares--1, 4, 5 vs. 2, 3, 6 (see Figure 1).
Inside circles vs. inside squares--2, 3, 5, vs. 1, 4, 6.
Big vs. small--1, 2, 3, 4 vs. 5, 6.
Big vs. small--1, 2 vs. 3, 4, 5, 6.

Other correct classifications were possible but were never made.

The child has made a reversal shift if he classifies by both the first and the second type of classification, or else by both the third and the fourth type of classification. It is possible to classify correctly twice without making a reversal shift, but the child who classifies correctly three times must reverse along either the shape or the size dimension.

Measures were as follows:

Percentage of correct new classifications.
Presence of dimension reversal.
Percentage of inconsistent classifications. This is the type of incorrect response in which the division into piles is not consistent, e.g., if 1, 3, and 5 are put in one pile and 2, 4, and 6 are put in the other pile. This is wrong because there is nothing similar within each pile and different from the other pile.
Presence of global completion error. This is the same error as the above, except that in this case instead of making two piles the child treats the stimuli like two puzzles, making one large filled-in circle out of 1, 3, and 5, and one large filled-in square out of 2, 4, and 6. This was a common type of error.

Percentage of inconsistent explanations. These are explanations which are either irrelevant (e.g., "They are all red"), or which do not conform to what the child actually did. (E.g., if the child describes one pile as "all big" and the other as "all small", when actually the middle-sized objects, 3 and 5, are divided between the two piles.). In the case where the child has classified incorrectly, but then when asked to explain how they are the same he says that they are not the same, his explanation is then considered correct for this measure. It is a measure of whether the child can attend to dimensionality quite specifically.

Results.

Most children could classify correctly only once or twice. There were no significant differences in Percentage of correct classifications. There was a trend for the bilinguals to have more correct classifications, F (1,151) = 3.38, p = .065, bil. mean = 54%, mono. mean = 45% correct.

There were no significant differences for Ability to reverse dimensions.

On Percentage of inconsistent classifications the differences were significant, F (1,151) = 7.80, $p < .01$. The bilinguals had fewer inconsistent classifications, bil. mean = 17%, mono. mean = 30%.

On Presence of global completion error the differences were significant, F (1,151) = 6.79, $p < .01$. The bilinguals had less of this type of error, bil. mean = .34, mono. mean = .62.

On Percentage of inconsistent explanations the differences were significant, F (1,151) = 14.64, p = .001. The bilinguals were less inconsistent, bil. mean = 9% inconsistent, mono. mean = 50%.

Discussion of classification results.

There was a consistent tendency on both classification tests for the bilinguals to give more classifications, but in neither case were the results significant. There was a significant advantage for the bilinguals on several measures. The advantage appears to be more a matter of attention to detail than of spontaneous switching ability. For example, the bilinguals were not better at reversals, and although they tended to perseverate less, this was not significant.

Attention to detail appears in that the bilinguals' classifications were less inconsistent than those of their comparison group on Part 2. It also appears in that their classifications were less global, i.e., the bilinguals were better able to resist the tendency to merge objects into larger wholes. The fact that their explanations were also more consistent on Part 2 also shows more attention to detail.

Another finding in the same direction is that the bilinguals used significantly more designs on Part 1, i.e., they used more subclassifications within their major classification. The reason that the bilinguals tended to have more "wrong dimension" explanations on Part 1 was because they did use more subclassifications. When the child subdivided his two piles into subclassifications he tended to forget that the major distinction is between the two piles, and instead of describing the major dimension difference, he describes a dimensional distinction within a pile. These two related characteristics both reach significance only among the older bilinguals, relative to the older monolinguals.

For the younger bilinguals there is some evidence of increased flexibility or switching ability, inasmuch as they do have fewer perseverative classifications than the younger monolinguals.

There are two pieces of evidence indicating that the bilinguals were more responsive to the perceptual "hints" in Part 1 than were the monolinguals. The monolinguals tended to give more perseverative responses and therefore they received more "hints" than did the bilinguals. The "hints" are actually additional trials, so the monolinguals received more trials than the bilinguals. The mean number of correct classifications for the monolinguals was only 1.84, meaning that they had less than two trials correct. This means that the monolinguals probably did not benefit much by the extra "hint" trials given to them when they perseverated. Taken by itself, this might mean only that the "hint" procedure itself was ineffective. However, other evidence indicates that the monolinguals are actually less responsive to the hints when they receive them than are bilinguals when they receive the hints. Therefore the reason why the bilinguals are more nearly significantly better at percentage correct was at least partly because they were more responsive to what hints they did receive.

The other evidence comes from a factor analysis done separately for bilinguals and monolinguals on the same set of 35 major variables drawn from the whole battery of tests (rotated orthogonally by Varimax method). The factors chosen were not necessarily those that showed significant differences between groups but those which were most important theoretically (e.g., Age, Peabody Vocabulary, Paradigmatic Associations, Symbol Substitution, Percent Correct Classifications, Percent Perseverative Classifications). For the monolinguals it was found that Perseverative Classifications was negatively related to Percentage of Correct Classifications, which is what one would expect. However, for the bilinguals the relationship was not negative. What this must mean is that the bilinguals did give perseverative responses but that they were able to respond to the stimulus "hints" better than were the monolinguals. That is, once given feedback they seemed to correct their errors faster.

D. Social Egocentrism.

The test.

The measure was from performance on three series of cartoon pictures to which the child must tell the story indicated by each sequence. Two sets were from Chandler & Greenspan (1972) and the third from Flavell, Botkin, Fry, Wright, & Jarvis (1968).

The Chandler & Greenspan stories, "Snowman" and "Window", require the child to understand the points of view of two different characters in the story: first the protagonist and then an observer who appears only after the main story event has already occurred, and who therefore lacks information about the reasons for the protagonist's behavior. The Flavell, et al. story, "Dog-Apple", requires the child to relate the obvious story told by the pictures. After this, several of the pictures in the sequence are removed, which changes the meaning of the remaining pictures. The child must tell a new story, as if he had not been exposed to the removed pictures.

As illustration of the two-viewpoint stories, the "Snowman" story is as follows: In picture 1 a girl makes a snowman under a sunny sky. In later pictures the snowman increasingly melts, and the girl's face becomes increasingly sad, till she walks away, downcast. She keeps walking. Suddenly she notices smells ("smell waves"). She becomes aware that she is standing near a bakery, and she looks in the window, expectantly. The baker inside

brings to the window a tray full of snowman cookies, while smiling at the girl. The girl's face changes to a sad expression when she sees the snowman cookies, *and she walks away in tears. The baker shrugs, as if* puzzled. His "thought balloon" contains a question mark.

Upon completion of each story the tester conducted a set probe concerning the last pictures of the story, those that contain the "observer". Only in a few cases was no inquiry necessary because the child's original story indicated clearly enough that the different point of view of the baker and the reasons for it were well understood.

The set probe in the snowman story was as follows: "Look at the baker here (pictures 6, 7, and 8). What does the baker think that the girl feels and thinks? I am not asking what you think the girl feels; I am asking what the baker thinks she feels."

If the answer was not clear the tester continued: "What does the baker think the girl feels that way about? I am not asking what you think the girl feels that way about, I am asking what the baker thinks the girl feels that way about."

In addition to the set probe, it was often necessary to continue the inquiry. The stories were often elliptical, and the tester needed to know whether a particular answer was really due to poor symbolic thought or was merely the result of poor fluency and poor vocabulary. This happened most often in the other two-viewpoint story, the "window" story, because this one demanded a fairly complex sentence structure.

This stage of inquiry could not be prescribed, but all questions by the tester were written down as close to verbatim as possible. Later, the responses were analyzed into stages, according to whether they were taken before any inquiry, after the set probe plus legitimate (nonbiasing) inquiry, or in response to leading inquiry. Testers differed on the limits of their inquiry, even after much discussion, so the only alternative was to analyze the inquiries later and eliminate all child responses which occurred subsequent to any question judged to be too leading. Two coders worked together on this decision.

Coding for egocentrism assigned from three points--high reduction of egocentrism--to zero points--egocentric. Criteria for the "Snowman" story were as follows:

3 points: The child indicates that the baker does not know why the girl is sad. Or the baker is allowed some reasonable inference about the reason for the girl's sadness, e.g., she is sad because she has no money to buy cookies. However, if the child also gave this as the girl's own reason for reacting with sadness to the sight of the cookies it does not get 3 points. The baker's rationale for the girl's behavior must be reasonable and at the same time different from the "real" reason given for the girl's behavior.

2 points: The child claims that the baker knew about the girl's snowman that melted. The rationalization is not justifiable by the pictures themselves, but at least it does not assume that the baker acquired the information in some magical way, or that he automatically knows what the girl is thinking. (E.g., "The bakery store was right near the playground and the baker could see her building her snowman.

1 point: The rationale for the baker's knowing about the previous incident is impossible. (E.g, "He knew what happened because he saw her get sad when she looked at the snowman cookies and he figured out what had happened."

0 points: The child sees no need to justify the baker's omniscience; or else the child fails to distinguish between the points of view of the girl and the baker or of himself and the baker. If at any point in the legitimate inquiry the child is able to achieve the double perspective, in spite of a slip into egocentrism, his response is coded in a higher category.

Not codable: Responses were not coded when both the child's explanation of the girl's sadness and the baker's understanding of the girl's sadness were the same and were both reasonable. (E.g., "She doesn't have enough money to buy the cookies. The baker thinks she is sad because she doesn't have money to buy the cookies.")

Results.

The general ability level for overcoming egocentrism on this test was low. Even for the older children only 33% were able to differentiate the two perspectives at the 3 point level.

When egocentrism was scored from the responses taken before any inquiry, there were no significant differences between groups for the two-viewpoint stories, and for the

story which required retelling ("Dog-Apple") the bilinguals were significantly worse, F (1,151) = 4.84, $p < .05$, bil. mean = .69, mono. mean = .87.

For the scores taken after legitimate inquiry the results were more varied. For the "Snowman" story the results after inquiry were not included in the major computer analysis because at that time the division between leading probes and acceptable probes had not as yet been completed. After completion a chi-square analysis was done in which categories 2 and 3 and categories 1 and 0 were combined. The results were significant in favor of the bilinguals, χ^2 (1,153) = 7.71, $p < .01$.

For the other two-viewpoint story ("Window") the results after inquiry were not significant, but there was a trend in favor of the bilinguals, F (1,151) = 3.59, $p = .067$, bil. mean = 1.50, mono. mean = 1.05. Oddly, for this story scores after inquiry were actually lower than before inquiry. What happened was that responses which had seemed to involve the ability to take the point of view of the other before inquiry often were found to be superficial and could not be maintained upon probing.

After legitimate probing on the "Dog-Apple" story the bilinguals were no longer significantly worse, F (1,151) = 1.58, N. S.

Discussion of egocentrism results.

The pattern of results was not strong enough to support the conclusion that the bilinguals were less egocentric, according to the current measure, since after inquiry the bilinguals were less egocentric on only one story, and before inquiry they were either not different or worse.

The wording of the set probe by the tester was intended to direct the child's attention towards the aspects of the stories which were of interest. If the probing could be considered as a hint to the child concerning what was required, then the difference between groups in response before any inquiry and after legitimate inquiry can be taken to indicate that the bilinguals respond better to hints than do the others.

E. Level of Integration.

The test.

The two Chandler & Greenspan stories were also coded for their level of integration. Highest integration was coded as three, lowest as zero.

"Integration" was defined as ability to see the difference between the two parts of the story and to relate them adequately. A sort of global merging was not considered to be integration. Coding categories for "Snowman" were as follows:

3 points: The girl's sadness at sight of the snowman cookies is understood to be because the sight reminds her of her earlier snowman.

2 points: The girl's sadness at sight of the snowman cookies is not associated with the earlier snowman, although the explanation is otherwise reasonable. This is more or less a neutral category, neither very integrated nor very global.

1 point: Connection to the earlier snowman is somewhat global, e.g., "She is sad because she wants a big snowman, not a little one."

0 points: Connection of the cookies to the earlier snowman is excessively global. For example, in the following what is expressed is complete identification rather than relationship: "Both are frosty the snowman"; "The cookies are made out of ice".

Stories which are otherwise unintegrated or disorganized are also included in this category.

The above coding system was supplemented by three more particular categorical measures which concern the same variables. These were taken only from the "Snowman" story, as follows:

Undetailed causal explanation. This is considered to occur when in response to the probe question, "What is she sad about?",on card 7 (immediately after seeing snowman cookies) the child answers something like, "She is sad about her snowman melting", without mentioning anything about the sight of the cookies acting as instigator of this memory. The child leaves out an important detail which connects the two parts of the stories explicitly. The omission seems to imply that nothing new has happened, as if the girl's sadness has been carried over intact from the earlier situation, and ignoring what has happened on card 6, where the girl appears interested, not sad.

Anticipation. This depends upon the description of the approach of the girl to the bakery, as she is attending to the "smell waves". Unwarranted anticipation occurs when the child says that the girl in the story "smells cookies", or even, "smells snowman cookies". The girl in the story could

not have identified the smell as from cookies, specifically, because she has not yet looked in the bakery window. The baker has not even brought the cookies into the window yet.

Internalized action. This is when it is clear from the child's description, whether spontaneous or after the probe, that the sight of the snowman cookies reminds the girl of her snowman.

Results.

On the "Snowman" story the bilinguals integrated significantly better, F (1,151) = 5.93, $p<.05$, bil. mean = .69, mono. mean = .48.

On the "Window" story there were no significant differences. The "Window" story involves a situation which is more difficult for the children to describe, because it is complex, but the story presents no sudden discontinuity in its middle, as does the "Snowman" story, and in this sense it was intrinsically easier to integrate.

All three of the categorical measures were significant in favor of the bilinguals: Undetailed causal explanation, F (1,151) = 6.93, $p<.01$, bil. mean = .09, mono. mean = .25. Thus, the bilinguals more often include the connecting detail. Anticipation, F (1,151) = 8.69, $p<.01$, bil. mean = .03, mono. mean = .20. Thus, the bilinguals less often make unwarranted anticipations. Internalized action, F (1,151) = 4.92, $p<.05$, bil. mean = .26, mono. mean = .12.

Discussion.

Some of these measures, especially Undetailed causal explanation, may concern communicative competence as much as integration.

The measure concerning Anticipation was really derived ad hoc from observation of the protocols rather than from theory. The finding that bilinguals make fewer unwarranted anticipations fits in with the attention to detail they demonstrate in other tests. On the other hand, their behavior on the Verbal Transformations Test, described earlier, seemed to involve a sort of searching for organization, which would seem compatible with anticipations. Perhaps one should be cautious in generalizing too readily from tests involving auditory reception to tests involving story telling.

F. Intelligence.

The test.

Wechsler Intelligence Test subtests were treated as dependent variables in an ANOVA in which Linguality, Age, and Sex were independent variables.

Results.

The bilinguals scored significantly higher on the Picture Completion subtest, F (1,187) = 14.76, $p<.001$, bil. mean = 11.90, mono. mean = 10.31. There were no main trends for Picture Arrangement or Digit Span. Similarities showed a non-significant trend, F (1,187) = 2.93, p = .085, bil. mean = 12.17, mono. mean = 11.46.

The WISC IQ, as estimated from the four subtests was superior for the bilinguals, F (1,187) = 3.93, p = .046, bil. mean = 110.51, mono. mean = 106.83.

Discussion.

Success on Picture Completion requires scanning of the details of the presented picture to check how it might deviate from one's internal model of what such a picture ought to include. Although their superiority on this subtest had not originally been predicted, the results might be regarded as another example of the bilinguals' tendency to attend to details.

The superiority in the estimated WISC IQ was, of course, a function of the particular subtests used as input. The finding for Picture Completion and the trend for Similarities in favor of the bilinguals is indeed interesting. Naturally, however, the overall IQ result would be different if the full range of subtests were used.

The table below summarizes the major test results.

TABLE 1

Summary of Results of Comparison between Bilinguals and Monolingual Children on Performance

SYNTAX TESTS

Test	Measure	Group with Higher Mean (p's noted for trends)[a]
Verbal Transformations	Total number changes heard	Bilinguals**
	Number different forms heard	Bilinguals**
	Number changes, 1st 30 seconds	Bilinguals**
	Latency, 1st change	Monolinguals*
	Number real English words reported	Monolinguals (p=.175)
	Number of "rhythm" responses	Monolinguals*
	Denial that changes reported were "real"	No trend
Symbol Substitution	Total test score	No trend
	Avoidance of "global error", i.e. of whole sentence replacement instead of analysis	Bilinguals*
	Avoidance of "global error", interaction effect	Young bilinguals*
Grammar Usage --		
Phrase structure:	% ungrammatical sentences, sum both languages	Bilinguals**
	% main verb errors, best language	Bilinguals***
	% preposition errors, best language	Bilinguals**
	Number of modals, best language	Monolinguals (p=.060)
Complexity:	% clausal sentences	No trend
	% errors in clausal sentences	Bilinguals**
Logic:	% illogical clauses	No trend

(continued)

TABLE 1 (continued)

Test	Measure	Group with Higher Mean (p's noted for trends)[a]
SEMANTIC TESTS		
Associations	Number paradigmatic associations	No trend
	Number paradigmatic-like associations	Bilinguals*
	Pattern using negative associations as paradigmatic	Bilinguals**
Peabody Vocabulary (English only)	"IQ" score	Monolinguals***
ANALYTIC TESTS		
Matrix Transposition	Transposition performance score	No trend
	Ability to tell or show how blocks are "similar"	Bilinguals (p=.182)
	Ability to tell or show similar, interaction effect	Young bilinguals (p=.068)
	Explanation by show preferred to tell, interaction	Young bilinguals*
	Use of relational terminology	Monolinguals (p=.179)
Egocentrism		
Snowman story:	Ability to take 2 viewpoints, before inquiry	No trend
	Ability to take 2 viewpoints, after inquiry	Bilinguals**
Window story:	Ability to take 2 viewpoints, before inquiry	Monolinguals (p=.108)
	Ability to take 2 viewpoints, after inquiry	Bilinguals (p=.067)
Dog-Apple story:	Ability to reinterpret story, before inquiry	Monolinguals*
	Ability to reinterprety story, after inquiry	No trend

(continued)

TABLE 1 (continued)

Test	Measure	Group with Higher Mean (p's noted for trends)[a]
Story Integration		
Snowman story:	Integrating details	Bilinguals**
	Mention of crucial detail uniting parts of story	Bilinguals**
	Unwarranted anticipation	Monolinguals**
	Internalized action	Bilinguals*
Window story:	Integrating details	No trend
WISC Intelligence	Picture Completion	Bilinguals***
	Estimated "IQ" total	Bilinguals*
	Similarities	Bilinguals (p=.085)
	Similarities, interaction effect	Older bilinguals*
	Picture Arrangement	No trend
	Digit Span	No trend
	Digit Span, interaction effect	Younger bilinguals (p=.052)
Classification 1	% correct classifications	Bilinguals (p=.117)
	% correct classifications, interaction effect	Young bilinguals (p=.096)
	Number correct classifications	Bilinguals (p=.088)
	Number correct classifications, interaction effect	Young bilinguals (p=.079)
	% classifications not perseverative	Bilinguals (p=.063)
	% gratuitous use of designs in classification	Bilinguals*
	% gratuitous designs, interaction effect	Older bilinguals (p=.064)
	% explanations inconsistent with classification	No trend
	% explanations inconsistent, interaction effect	Older bilinguals*

(continued)

TABLE 1 (continued)

Test	Measure	Group with Higher Mean (p's noted for trends)[a]
Classification 2	% correct classifications	Bilinguals ($p=.065$)
	% consistent classifications	Bilinguals**
	Combining stimuli into a complete global whole instead of classifying analytically	Monolinguals**
	% explanations inconsistent with classification	Monolinguals***
	Ability to reverse dimension	No trend

Note. Results are from an analysis of variance in which Linguality, Age, and Economic Level were independent variables and WISC Intelligence was treated as covariate. Exceptions are as follows: a) Under Association the measures called "Number of paradigmatic-like associations" and "Pattern using negative associations as paradigmatic" were from t-tests; b) The WISC Intelligence results are from a separate analysis of variance with Linguality, Age, and Sex as independent variables.

[a]The p-value of the mean trend is reported only when the difference between groups shows a definite trend but is not significant at the $p \leq .05$ level. For trends which are significant the p-values as well as df, means, F, t, or χ^2 values appear in the text.

*$p \leq .05$

**$p \leq .01$

***$p \leq .001$

DISCUSSION

In the earlier Hebrew-English bilingual study the results were summarized into two strategies found to characterize the responses of tne bilinguals: attention to structure, and readiness to reorganize. There is also evidence for these two strategies on the part of the bilinguals in the present study, as follows:

Attention to structure--

Classification Test: The bilinguals attended to structure even when this was not strictly necessary. Although bilinguals were not better at reclassification, their explanations of classifications were more consistent with their performance, which also showed consciousness of structure. Bilinguals also had fewer errors of the global type.

Story Test: Bilinguals more often mentioned a necessary detail integrating both parts of the story. (In a factor analysis of major test variables this measure did not correlate highly with the other tests that indicate attention to structure. Perhaps the result on this measure indicates attention to important details of social situations necessary for communicative competence.)

The bilinguals also took the details in sequence, without making unwarranted assumptions.

WISC Picture Completion: The bilinguals were significantly better. Presumably this was because of greater scanning of the details of the presented picture to check how it might deviate from an internal model of what the picture ought to include.

Symbol Substitution: The bilinguals had fewer global-type errors.

Matrix Transposition: Differences were not significant, but the young bilinguals tended to be more capable of isolating the one dimension by which different shapes in the matrix which varied in several attributes were "the same". This was in the same direction as in the earlier study, where the difference had been significant.

Associations: When Conceptual associations were defined partly in terms of syntactic structure, there were no significant differences in Conceptual associations. When the measure was taken in such a way as to minimize vocabulary requirements as well as considerations of syntax, the bilinguals had more associations related to conceptual (semantic) structure than did the others.

Readiness to reorganize--

Verbal Transformations: The bilinguals showed greater efforts at auditory reorganization. Another kind of readiness to reorganize was shown, perhaps, by the fact that when the tester asked if there really had been changes in the stimulus or not, the bilinguals often said that there had not been changes. This can be interpreted either as cognitive flexibility or as anxiety to please and sensitivity to the social hint that they may have been mistaken.

Classification and Reclassification: The bilinguals were more receptive to "hints" of a perceptual nature which were provided when their responses were incorrect. They took advantage of these hints by using them as cues to successful restructuring. On the other hand, the bilinguals were not significantly better at reclassifying, although such trends existed for both parts 1 and 2 of the test.

Symbol Substitution: This test did not support the hypothesis, since the bilinguals were not better at substituting word symbols for each other, which requires detachment of the words from their customary grammatical organizational framework. Certain differences in types of errors, however, indicate that if the sentences had been shorter and simpler, the bilinguals may have shown advantage.

Story Test: The bilinguals were more likely than others to improve their responses (react less egocentrically) following set probe questions concerning relationships between characters in the story. Again, it is difficult to know whether to interpret this as ability to react to cognitive feedback more flexibly or as social sensitivity to the probe as an implicit criticism.

Level of egocentrism is related to readiness to reorganize, since ability to view a situation from more than one standpoint implies ability to reorganize. There was some evidence in favor of the bilinguals' ability to take more than one point of view in relating the stories, but there was also contradictory evidence.

Summary-- Both of the strategies found in the earlier study were also found in the present one, but with some attenuation. Attention to structure was present, running through several different tests, but in the present study it was less evident in regard to processing of syntactic structure by the bilinguals. This is surprising, since it was assumed that if attention to structure by the bilinguals should appear on tasks unrelated to grammar, this is through generalization of skills gained through dealing with conflicts between their

two syntactic systems. Perhaps the grammar tests used were not suitable. Counting mistakes in usage does measure performance, but not necessarily competence. The Symbol Substitution Test was, on the whole, too difficult for these subjects. More subtle tests of syntax understanding might be useful.

The evidence for reorganizational ability was also present but less strong than in the previous study.

Conclusion

We may conclude that the effort to become bilingual results in greater ability to process systemic structures, even for bilinguals in relatively disadvantaged circumstances, in which there are fewer opportunities to encounter outstanding speech models and fewer special rewards for complex verbalization. The Spanish-English bilinguals of this study also differ from the Hebrew-English bilinguals of the previous study in that their two languages are much more similar to each other in structure and in vocabulary (there are very few Hebrew-English cognates). In a way, the language similarity promotes interlingual transfer and thus greater interference, but, on the other hand, changing from one language context to the other or translating from one to the other probably is less of a challenge to reorganizational ability.

Although translation ability was not found to be related to performance in either study, different approaches to translation between the two bilingual groups may be related to the differences between them in the intensities of the strategies they manifest. Among the Hebrew-English bilinguals a child who was balanced in that he could translate as well in one direction as the other also tended to have fewer total translation errors. For the Spanish-English bilinguals, on the other hand, a high balance score could be achieved through few errors, but it could also be the result of performance containing many errors which went in both directions equally. Yet the balance score did have validity, since it was highly related to ability to tell a story in one language without inadvertently slipping into the other language.

Perhaps some of the Spanish-English bilinguals were concentrating not on learning how to switch from one language to the other, which involves interlingual analysis, but rather on learning how to stay within the confines of one language at a time without slipping into the other and causing themselves embarrassment. This would require attention to details of structure and to social aspects of the environ-

ment more than to reorganization. Other bilinguals in this group seem more like those in the previous study.

Whatever advantages were seen for the bilinguals in structural processing were usually more marked among the younger bilinguals. The same was true in the earlier study. It is not clear why this should be, but possibly it concerns the fact that the younger bilinguals are closer in time to the initial confrontation between the two languages. The advantages seemed to be maintained better in the earlier study, where motivational conditions were more favorable to maintaining bilingualism, so it may be that long-term maintenance of the effects of bilingualism on cognitive processing depends upon the circumstances of the confrontation between the two languages, in addition to sheer exposure.

FOOTNOTE

[1]This project was funded by research grant HD-08393 from the United States National Institute of Child Health and Human Development, and by a preliminary grant from the State of Illinois Office of Education. Assistance of Julietta Rosales de Pasko, Karla Moras, Carlos Roll, Paula Garland and Michael Levins is gratefully acknowledged. The author also wishes to thank H. Ned Seelye and the principals, teachers, and parents of the schools in which testing was done, and to thank the children for their cooperation.

REFERENCES

Ben-Zeev, S. The influence of bilingualism on cognitive development and cognitive strategy. Ph. D. dissertation, University of Chicago, 1972.

Ben-Zeev, S. The effect of Spanish-English bilingualism in children from less privileged neighborhoods on cognitive development and cognitive strategy. Research report to U. S. Department of Health, Education and Welfare, 1975.

Ben-Zeev, S. The influence of bilingualism on cognitive strategy and cognitive development. Child Development, 1977, 48.

Bloom, L. An integrative perspective on language development. Papers and Reports on Child Language Development, 1976, 12, 1-22. Stanford University.

Bruner, J. S., & Kenney, H. On multiple ordering. In J. Bruner, R. Olver, & P. Greenfield (Eds.), Studies in cognitive growth. New York: Wiley, 1966.

Chandler, M. J., & Greenspan, S. Ersatz egocentrism: A reply to H. Borke. Developmental Psychology, 1972, 7, 104-106.

Flavell, J., Botkin, P., Fry, C., Wright, B., & Jarvis, P. The development of role-taking and communication skills in children. New York: Wiley, 1968.

Inhelder, B., & Piaget, J. The early growth of logic in the child. New York: Harper & Row, 1964.

McNeill, D. Development of the semantic system. Unpublished manuscript, 1971.

Nie, N. H., Hull, C. H., Jenkins, J. G., Steinbrenner, K., & Bent , D. Statistical package for the social sciences, 2nd Edition, New York: McGraw Hill, 1975.

Warren, R. M., & Warren, R. P. A comparison of speech perception in childhood, maturity, and old age by means of the verbal transformation effect. Journal of Verbal Learning and Verbal Behavior, 1966, 5, 142-146.